

SCREWDRIVER WITH LIGHT DEVICE

FIELD OF THE INVENTION

The present invention relates to screwdriver having a light device connected to an end surface of the handle and an annular switch is
5 rotatably connected to the handle.

BACKGROUND OF THE INVENTION

A conventional screwdriver with a light device is developed for a period of time and the light device provides illumination feature for the user in a dark work site. This feature is convenient for the users and
10 welcomed in the market, nevertheless, the light device is simply attached to a screwdriver as an extra attachment so that the light bulb generally protrudes from the outer periphery of the handle and could impede the operation of the screwdriver in a narrow space. Besides, the appearance of the handle is not satisfied by the users because the light device and the
15 switch both protrude from the handle. Furthermore, the conventional light device can only be attached to a periphery of the handle so that the light beam cannot be focused onto the same spot where the object is to be tightened or loosened by the screwdriver.

The present invention intends to provide a screwdriver that has
20 a light device located at an end surface of the handle and the switch is in flush with the outer surface of the handle.

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention, there is provided a screwdriver that includes a handle with a plastic gear mechanism received therein and a bit engaging device is connected to a first end of the gear mechanism. A power source is connected to the gear mechanism. A positive plate and a negative plate are respectively connected to the gear mechanism. A light frame is received in the handle and at least one light bulb is connected to the light frame. A positive ring and a negative ring are respectively engaged with the light frame. A spring is mounted to the bit engaging device and connected between the negative ring and the negative plate. The at least one light bulb is connected to the positive ring and the negative ring. A gap is defined between the positive plate and an extension of the positive ring.

An annular switch is rotatably mounted to the gear mechanism and includes a touch piece which contacts both of the position plate and the extension of the positive ring to light the at least one light bulb.

The present invention will become more obvious from the following description when taken in connection with the accompanying drawings which show, for purposes of illustration only, a preferred embodiment in accordance with the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view to show a screwdriver of the present invention;

Fig. 2 is an exploded view to show the light device and the gear mechanism for the screwdriver of the present invention;

Fig. 3A is a cross sectional view to show the contact piece of the annular switch contacts the position plate and the extension of the positive ring;

Fig. 3B is a cross sectional view to show the contact piece of the annular switch is removed not to contact the position plate and the extension of the positive ring;

Fig. 3C shows the light bulbs connected to the light frame;

Fig. 4 shows the arrangement of the positive plate, the negative plate and the light frame;

Fig. 5 shows another embodiment of the light device of the present invention;

Fig. 6 is a side cross sectional view to show the embodiment shown in Fig. 5;

Fig. 7 shows the arrangement of the positive plate, the negative plate, the positive ring of the embodiment shown in Fig. 5;

Fig. 8 is an exploded view to show yet another embodiment of the present invention;

Fig. 9A is a cross sectional view to show the contact piece of the annular switch contacts the position plate and the extension of the positive ring shown in Fig. 8;

Fig. 9B shows the light bulbs connected to the light frame in the embodiment in Fig. 8;

Fig. 10 is a perspective view to show the status as shown in Fig. 9A;

5 Fig. 11 is a perspective view to show the screwdriver cooperated with a torque adjusting device;

Fig. 12 is an exploded view to show the light device, the gear mechanism and the torque adjusting device for the screwdriver of the present invention shown in Fig. 11;

10 Fig. 13 is a cross sectional view to show the embodiment as shown in Fig. 11, and

Fig. 14 is a perspective view to show the status when the contact piece of the annular switch contacts the position plate and the conductive port.

15 **DETAILED DESCRIPTION OF THE PREFERRED**
EMBODIMENT

Referring to Figs. 1, 2, 3A, 3B, 3C and 4, the screwdriver 10 of the present invention comprises a handle 20 having a plastic gear mechanism 30 and a bit engaging device 35 is connected to a first end of the gear mechanism 30 so that a sleeve "a" can be connected to the bit engaging device 35. A power source 100 is connected to the gear mechanism 30 so as to provide electric power to the gear mechanism 30 to rotate the sleeve "a". The gear mechanism 30 includes a ring 31 which

includes teeth defined in an inner periphery thereof so as to drive gears (not shown) in the gear mechanism 30. Two ridges 311 extending from an outer periphery of the ring 31 and are engaged with grooves 32 (only one is shown) defined longitudinally in the gear mechanism 30. A
5 positive plate 33 and a negative plate 34 are respectively inserted into the grooves 32 via openings 321 in the first end of the gear mechanism 30.

A light frame 40 is connected to the gear mechanism 30 and includes two bulb receiving members 421 on a flange 42 of an inner periphery of the light frame 40. Two light bulbs "b" are connected to the
10 bulb receiving members 421 of the light frame 40. The light frame 40 includes a connection end 41 which is connected to the gear mechanism 30. A positive ring 45 and a negative ring 43 are respectively engaged with the light frame 40. The positive ring 45 has two connection pieces 451 inserted in the two bulb receiving members 421 and the negative ring
15 43 has two connection pieces 431 which are inserted in the two bulb receiving members 421 so that the two light bulbs "b" are connected to the positive ring 45 and the negative ring 43. A fixing collar 44 is engaged in a groove 351 defined in an outer periphery of the bit engaging device 35 so as to press the negative ring 43 in position.

20 A fixing ring 60 which is engaged with the first end of the gear mechanism 30 and includes a central hole through which the bit engaging device 35 extends. Two positioning holes and two bulb holes 61 are defined through the fixing ring 60. The light frame 40 includes two

positioning rods 422 which extend through the positioning holes and the light bulbs "b" extend through the two bulb holes 61.

A spring 36 is mounted to the bit engaging device 35 and connected between the negative ring 43 and the negative plate 34. A gap
5 is defined between the positive plate 33 and an extension 452 of the positive ring 45 to form an open circuit for the light bulbs "b".

An annular switch 50 is rotatably mounted to the light frame 40 and includes a touch piece 51 which protrudes inward from an inner periphery of the annular switch 50 and can be moved to contact both of
10 the position plate 33 and the extension 452 of the positive ring 45 by rotating the annular switch 50 to light the light bulbs "b".

The light bulbs "b" are located at the end of the gear mechanism 30 and the annular switch 50 is in flush with the outer periphery of the handle 20 so that the present invention improves the
15 shortcomings of the conventional light device on the screwdriver.

Referring to Figs. 5 to 7, another embodiment of the screwdriver is shown and comprises a handle 20 having a plastic gear mechanism 30 received therein and a bit engaging device 37 is connected to a first end of the gear mechanism 30 which is connected to a power
20 source 100 (not shown). The gear mechanism 30 includes a ring 31 which includes teeth defined in an inner periphery thereof so as to drive gears (not shown) in the gear mechanism 30. Two ridges 311 extending from an outer periphery of the ring 31 and are engaged with grooves 32

(only one is shown) defined longitudinally in the gear mechanism 30. A positive plate 33 and a negative plate 34 are respectively inserted into the grooves 32 via openings 321 in the first end of the gear mechanism 30.

5 A light bulb "b" is inserted in a bulb receiving member 371 on the first end of the gear mechanism 30. A positive ring 38 is mounted to the bit engaging device 37 and includes a positive lug 381 and a negative lug 382. The light bulb "b" is connected to the positive lug 381 and the negative plate 34. A gap is defined between the positive plate 33 and the negative lug 382.

10 A fixing ring 60 is engaged with the first end of the gear mechanism 30 and includes a central hole through which the shank of the bit engaging device 37 extends. Two positioning holes and a bulb hole 61 are defined through the fixing ring 60. Two positioning rods 422 extend from the first end of the bit engaging device 37 and extend through the positioning holes and the light bulb "b" extends through the two bulb
15 holes 61.

An annular switch 50 is rotatably mounted to the gear mechanism 30 and includes a pressing portion 52 to press onto the positive ring 38 and a touch piece 51 protrudes inward from an inner
20 periphery of the annular switch 50, the touch piece 51 contacting both of the position plate 33 and the negative lug 382 of the positive ring 38 to light the light bulb "b".

Referring to Figs. 8, 9A, 9B and 10, yet another embodiment of the screwdriver comprises a handle (not shown) having a metal gear mechanism 30 and a bit engaging device 35 is connected to a first end of the gear mechanism 30. A power source 100 (not shown) is connected to the gear mechanism 30 so as to provide electric power to the gear mechanism 30 to rotate the sleeve "a". The gear mechanism 30 includes a ring 31 which includes teeth defined in an inner periphery thereof so as to drive gears (not shown) in the gear mechanism 30. Two ridges 311 extending from an outer periphery of the ring 31 and are engaged with a groove 32 defined longitudinally in the gear mechanism 30. A positive plate 33 is inserted into the grooves 32 via openings 321 in the first end of the gear mechanism 30.

A light frame 40 is connected to the gear mechanism 30 and includes two bulb receiving members 421 on a flange 42 of an inner periphery of the light frame 40. Two light bulbs "b" are connected to the bulb receiving members 421 of the light frame 40. The light frame 40 includes a connection end 41 which is connected to the gear mechanism 30. A positive ring 45 and a negative ring 43 are respectively engaged with the light frame 40. The positive ring 45 has two connection pieces 451 inserted in the two bulb receiving members 421 and the negative ring 43 has two connection pieces 431 which are inserted in the two bulb receiving members 421 so that the two light bulbs "b" are connected to the positive ring 45 and the negative ring 43. A fixing collar 44 is

engaged in a groove 351 defined in an outer periphery of the bit engaging device 35 and a spring ring 46 is sandwiched between the negative ring 43 and the fixing collar 44 so as to press the negative ring 43 in position and form a loop circuit.

5 A fixing ring 60 which is engaged with the first end of the gear mechanism 30 and includes a central hole through which the bit engaging device 35 extends. Two positioning holes and two bulb holes 61 are defined through the fixing ring 60. The light frame 40 includes two positioning rods 422 which extend through the positioning holes and the
10 light bulbs "b" extend through the two bulb holes 61. A gap is defined between the positive plate 33 and an extension 452 of the positive ring 45 to form an open circuit for the light bulbs "b".

 An annular switch 50 is rotatably mounted to the connection end 41 of the light frame 40 and includes a touch piece 51 which
15 protrudes inward from an inner periphery of the annular switch 50 and can be moved to contact both of the position plate 33 and the extension 452 of the positive ring 45 by rotating the annular switch 50 to light the light bulbs "b".

 Referring to Figs. 11 to 14, a screwdriver 10 with a torque
20 adjusting device 70 is shown and comprises a handle 20 having a metal gear mechanism 30 received therein and a bit engaging device 35 is connected to a first end of the gear mechanism 30 so that a sleeve "a" can be connected to the bit engaging device 35. A power source 100 is

connected to the gear mechanism 30 so as to provide electric power to the gear mechanism 30 to rotate the sleeve "a". The gear mechanism 30 includes a ring 31 which includes teeth defined in an inner periphery thereof so as to drive gears (not shown) in the gear mechanism 30. Two
5 ridges 311 extending from an outer periphery of the ring 31 and are engaged with a grooves 32 defined longitudinally in the gear mechanism 30. A positive plate 33 is inserted into the groove 32 via openings 321 in the first end of the gear mechanism 30.

A torque adjusting device 70 is mounted to the bit engaging
10 device 35 and has a base 71, a collar 72, a torque scale plate 73, a rotatable cap 74 and an end piece 75. The base 71 has a flange 711 and a threaded tube 712 connected to the flange 711, the collar 72 is mounted to the threaded tube 712. The flange 711 has a plurality of holes 7111 and each have a spring 721 extending therethrough. An end of each spring
15 721 contacts a pin 722 which urges a bead 723 received in recesses 39 defined in an end surface of the handle 20. The other end of each spring 721 contacts the collar 72. The torque scale plate 73 is mounted to the threaded tube 712 and the rotatable cap 74 is threadedly connected to the threaded tube 712 and compresses the torque scale plate 73. A plurality
20 of beads are engaged between the torque scale plate 73 and the rotatable cap 74.

A positive plate 33 is connected to the torque adjusting device 70 and connected to a power source 100. The flange 711 of the base 71 is

engaged with a positioning ring 80 and has an extension 7112. A
conductive port 7122 is connected to the extension 7112 and a conductive
ring 7121 is connected to an end of the threaded tube 712. An end of the
positive plate 33 is connected to the extension 7112 and a gap is defined
5 between the conductive port 7122 and the positive plate 33.

A light frame 40 is connected to a negative ring 43 which has
two connection pieces 431 and a connection portion 47 is connected to an
end of the light frame 40. A fixing collar 44 is engaged in a groove 351
defined in an outer periphery of the bit engaging device 35 so as to press
10 the negative ring 43 in position. The connection portion 47 is connected
with the positioning ring 80 and a position ring 45 is connected to the
connection portion 47. The positive ring 45 has two connection pieces
451 so that two light bulbs "b" inserted in two bulb receiving members
421 on the light frame 40 are connected to the two connection pieces 451
15 and two connection pieces 431 of the negative ring 43. The springs 721
pushes the conductive ring 7121 on the threaded tube 712 to contact the
positive ring 45.

A fixing ring 60 which is engaged with the first end of the gear
mechanism 30 and includes a central hole through which the bit engaging
20 device 35 extends. Two positioning holes and two bulb holes 61 are
defined through the fixing ring 60. The light frame 40 includes two
positioning rods 422 which extend through the positioning holes and the
light bulbs "b" extend through the two bulb holes 61.

An annular switch 50 is rotatably mounted to the positioning ring 80 and has a touch piece 51 which contacts the positive plate 33 and the conductive port 7122 to light the light bulbs "b".

5 While we have shown and described the embodiment in accordance with the present invention, it should be clear to those skilled in the art that further embodiments may be made without departing from the scope of the present invention.